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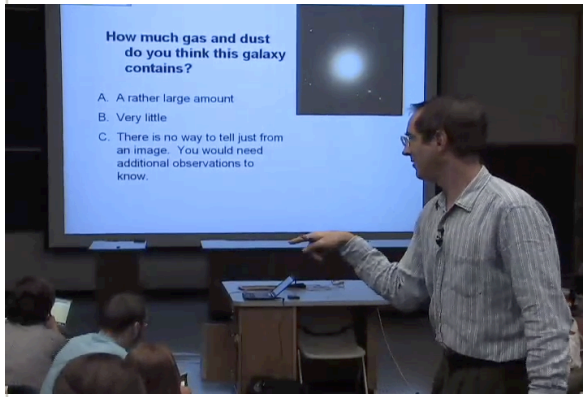
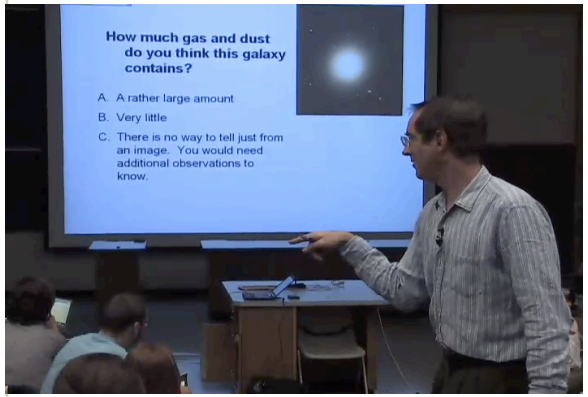
Credit should be given to: Stephanie Chasteen and the Science Education Initiative at the University of Colorado, http://colorado.edu/sei

Effective Facilitation of Clickers


How much gas and dust do you think this galaxy contains?
A. A rather large amount
B. Very little
C. There is no way to tell just from an image. You would need additional observations to know.

Stephanie Chasteen
University of Colorado Science Education Initiative

Part 1. Introduction


How much gas and dust do you think this galaxy contains?
A. A rather large amount
B. Very little
C. There is no way to tell just from an image. You would need additional observations to know.

- How can we most effectively use clickers?
- What is Peer Instruction?
- Why is it helpful?

Have you used response systems (clickers) as a teacher or a student?

Colored cards

A. Not at all, and I haven't seen them used

B. Not at all, but I've observed their use somewhat

C. I've used them a little

D. I've used them a lot

E. I could be (should be?) *giving* this workshop

You can download colored cards from our website, STEMclickers.colorado.edu

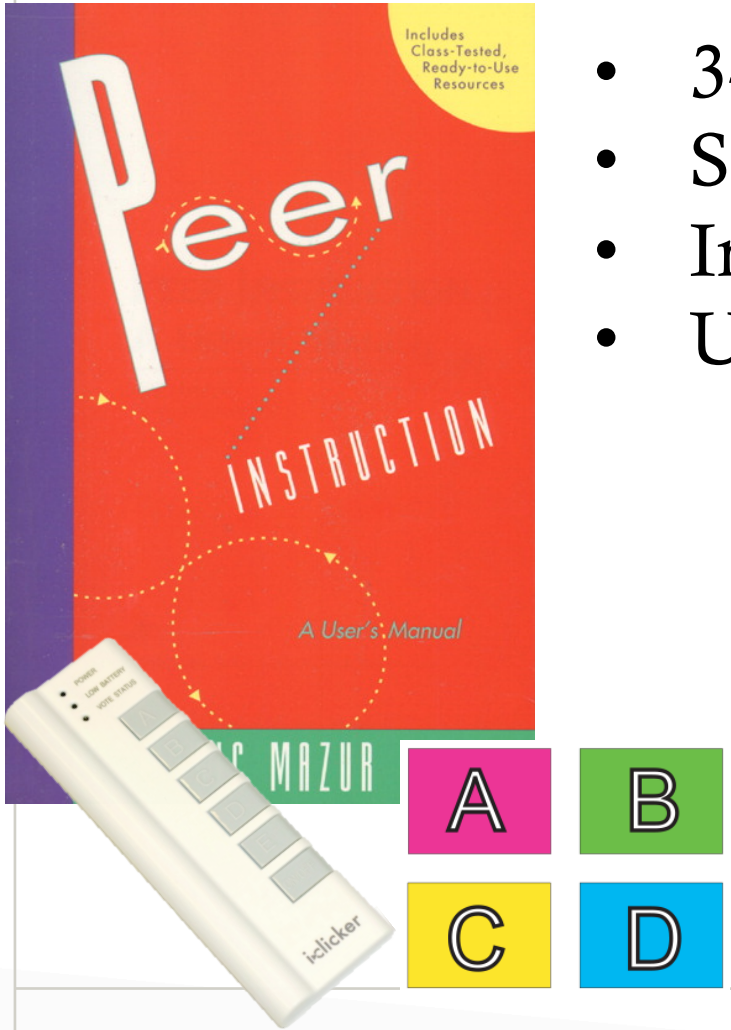
Clickers are a tool for questioning

But not a magic bullet!

Don’t equate the pedagogy with the technology.
So what IS the pedagogy?

Steph story

Peer Instruction is the recommended pedagogy used with clickers



- 3-5 questions per class
- Students discuss & vote
- Improved learning (multiple studies)
- Used by ~30% of physics faculty*

* Dancy & Henderson, AJP, 2010

What do you think of clickers and peer instruction?

- Take a clicker & turn it on
- Press and hold power button,
- Press "AA" to choose code
- Vote. If the green light lights, your vote has been counted

A. I use it, and am trying to use it better

B. I'm sold on it, and want information on how to start

C. I'm not so sure… want to hear more

D. I'm completely skeptical; I don't think this will work well for me/ my students

E. I don't really want to be here, but at least there's lunch.

Did you do the online assignment?

- Take a clicker & turn it on
- Press and hold power button,
- Press "AA" to choose code
- Vote. If the green light lights, your vote has been counted

A. Yes

B. No

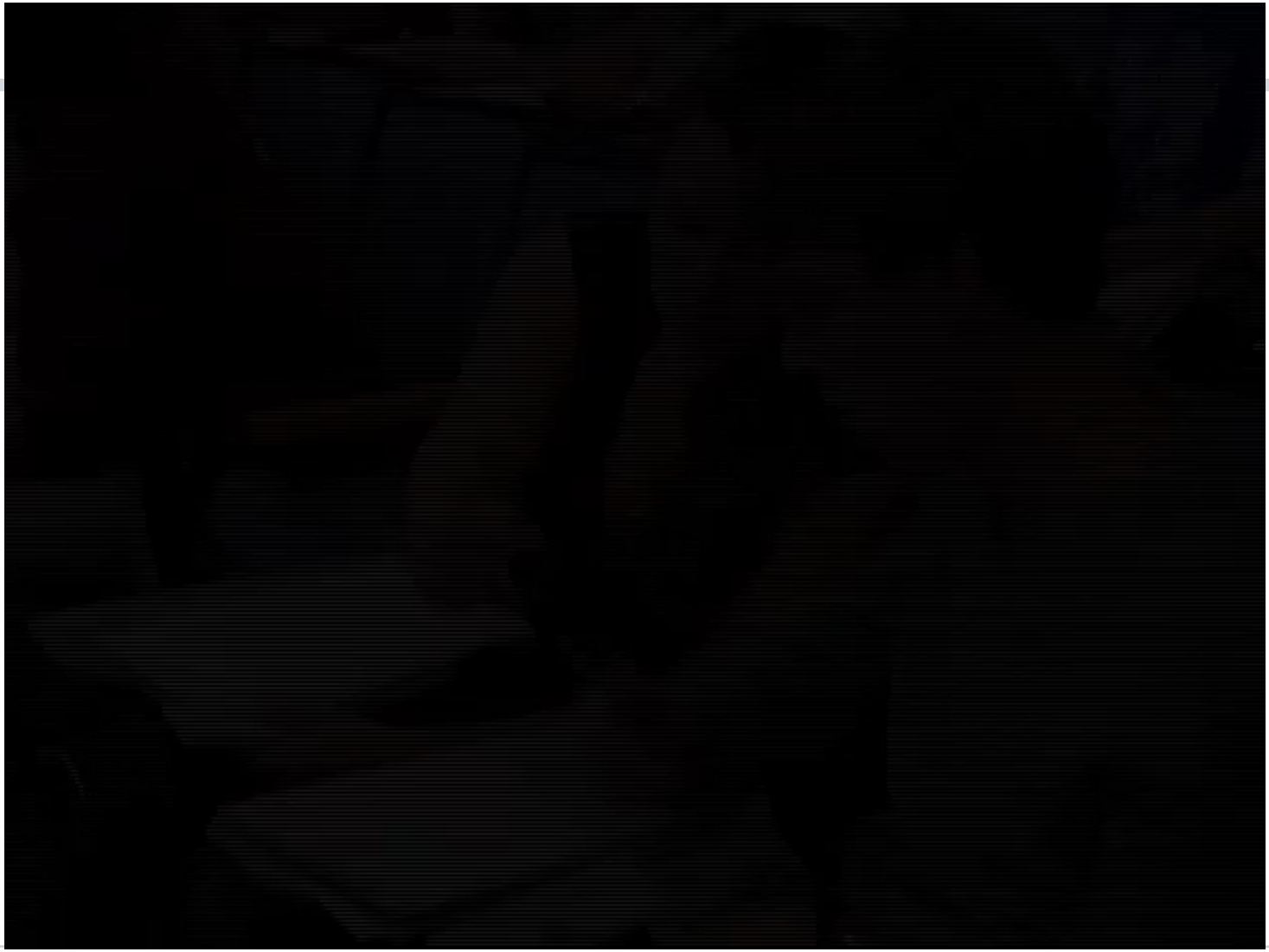
C. What assignment?

Warm Up: Why question?

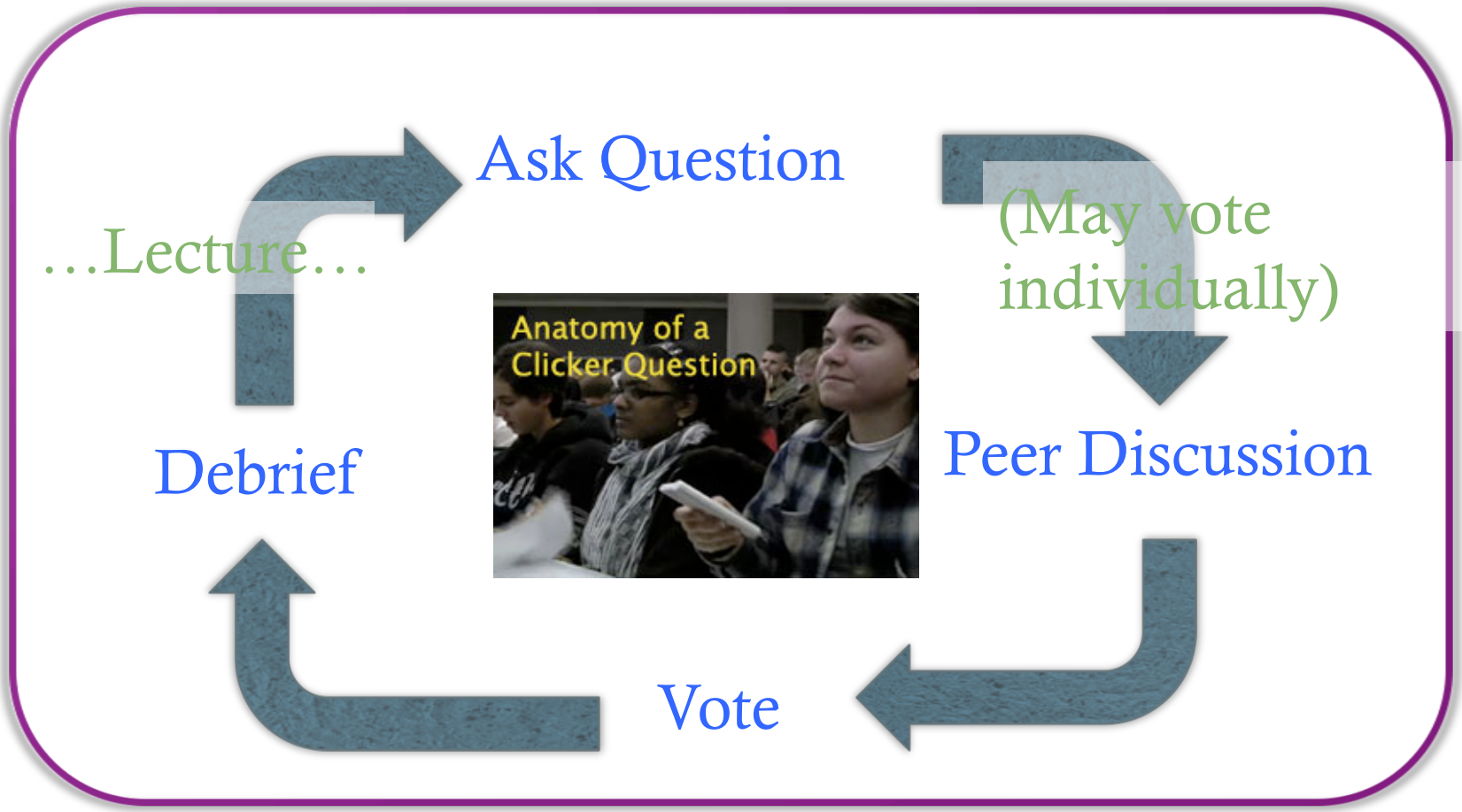
1. Why do we ask students questions in class?
2. Why might we use *clicker* questions? (What problems might they help us solve?)

Warm up activity
Discuss in small groups.
Then share out.

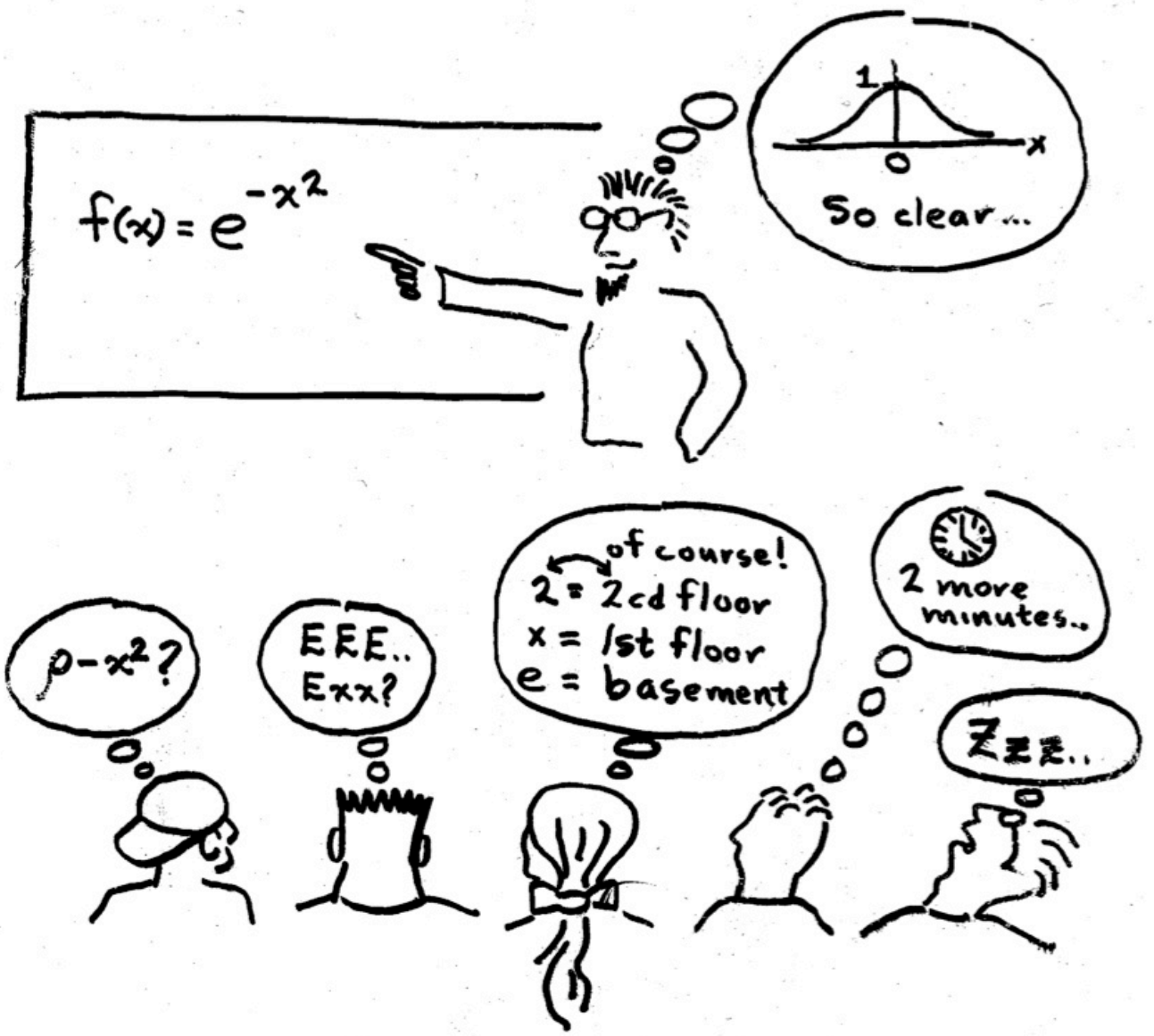
What is Peer Instruction?



Anatomy of Peer Instruction



*** See also: Peer Instruction, A User's Manual. E. Mazur.**

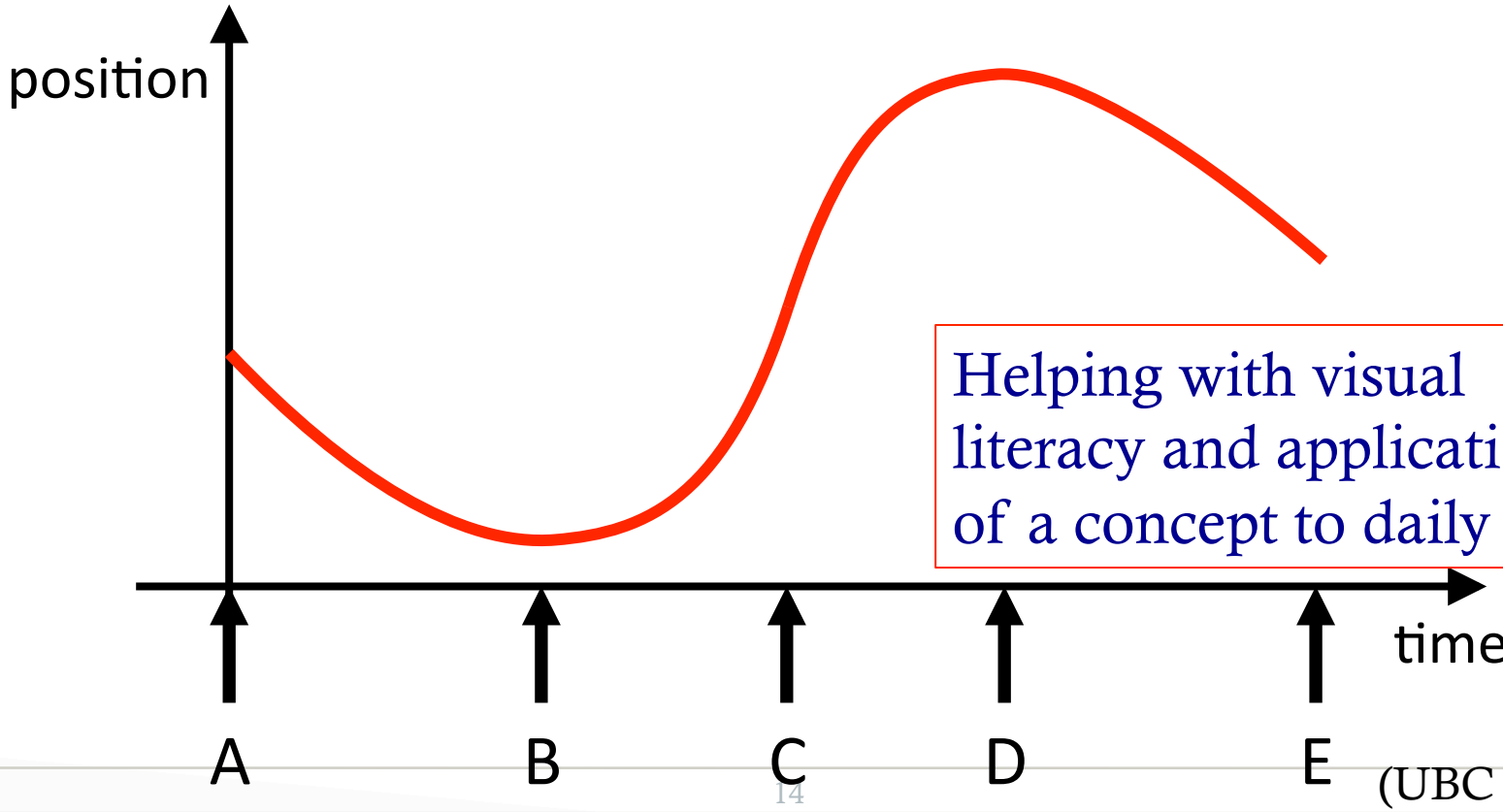

$f(x) = e^{-x^2}$
1
x
0
So clear...
$\rho - x^2$?
EEE..
Exx?
of course!
2 = 2cd floor
x = 1st floor
e = basement
2 more minutes..
Zzz..

JiTT questions

- Several of you asked questions about writing good clicker questions; that is covered in tomorrow's workshop (1-2:30).
- "Do we have to plan all our clicker questions in advance?"
- "Are clickers important for small classes?"

Example question: Physics

John is walking to school. This graph shows his position as a function of time. When is John moving with the greatest velocity?



Helping with visual literacy and application of a concept to daily life.

(UBC CWSEI)

Example Question: History

In your opinion, which has had the most positive impact on the modern world?

A) coffee
B) tea
C) chocolate
D) spice
E) sugar

Good discussion/debate question, before or after instruction

Example of a less effective question

"Apprized" means

A) Appreciated
B) Compromised
C) Defied
D) Noted

No need to talk to your neighbor; you know it or you don't! Does not encourage reasoning.

Another example of a better, but still not optimal question

What causes the seasons?

A) The change in the earth's distance from the sun during the year
B) The tilt of the earth's axis
C) Changes in the sun's brightness
D) Changes in clouds
E) None of the above

Can pattern-match to find the answer
Doesn't give much information about reasoning

Better seasons example

What would happen to the seasons if the earth's orbit around the sun was made a perfect circle (but nothing else changed) ?

A. There would be no seasons

B. The seasons would remain pretty much as they are today

C. Winter to spring would differ much less than now

D. Winter to spring would differ much more than now

Much better question. Requires reasoning!

Note that prediction often results in better questions.

Benefits of Peer Instruction

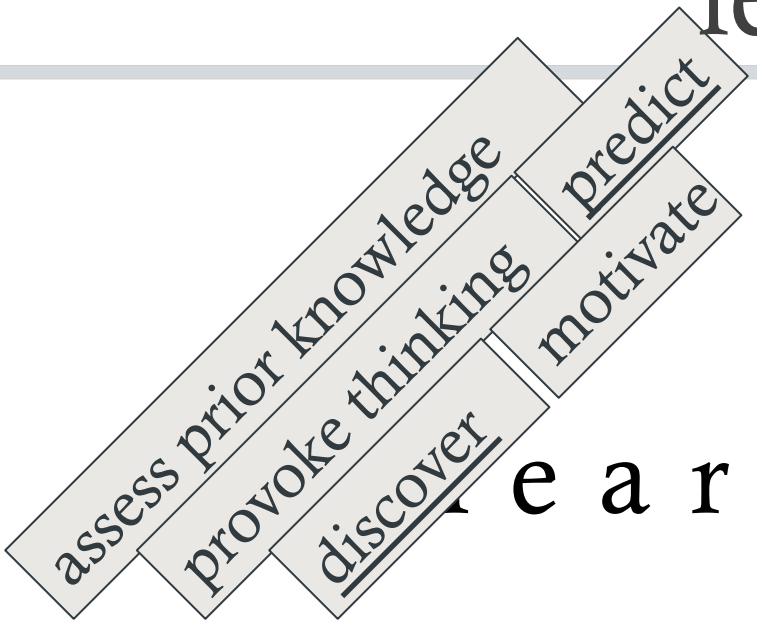
Questions help students learn...

t h e l e a r n i n g c y c l e

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help students learn...



l e a r n i n g c y c l e

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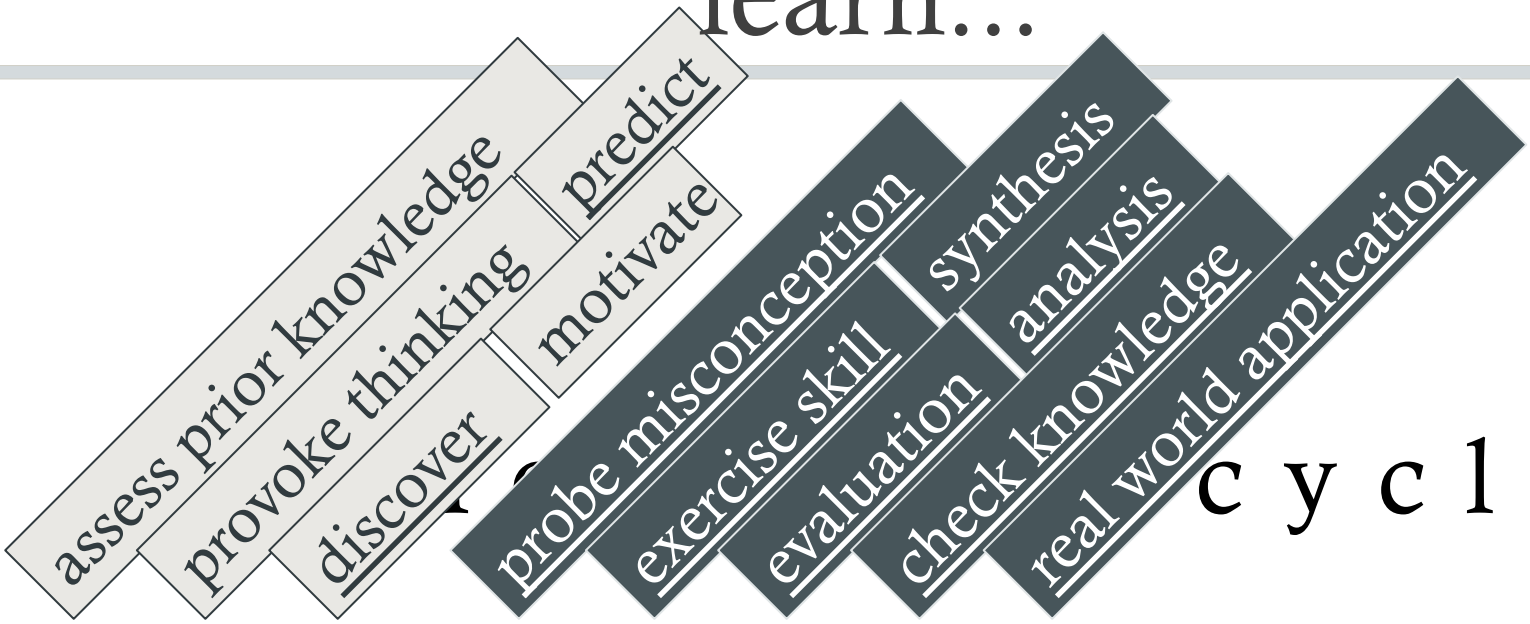
Questions help students learn...



BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help students learn…

setting up instruction

developing knowledge

assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help teachers teach…

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help teachers teach…

Are they ready for the next topic?

What do they already know?

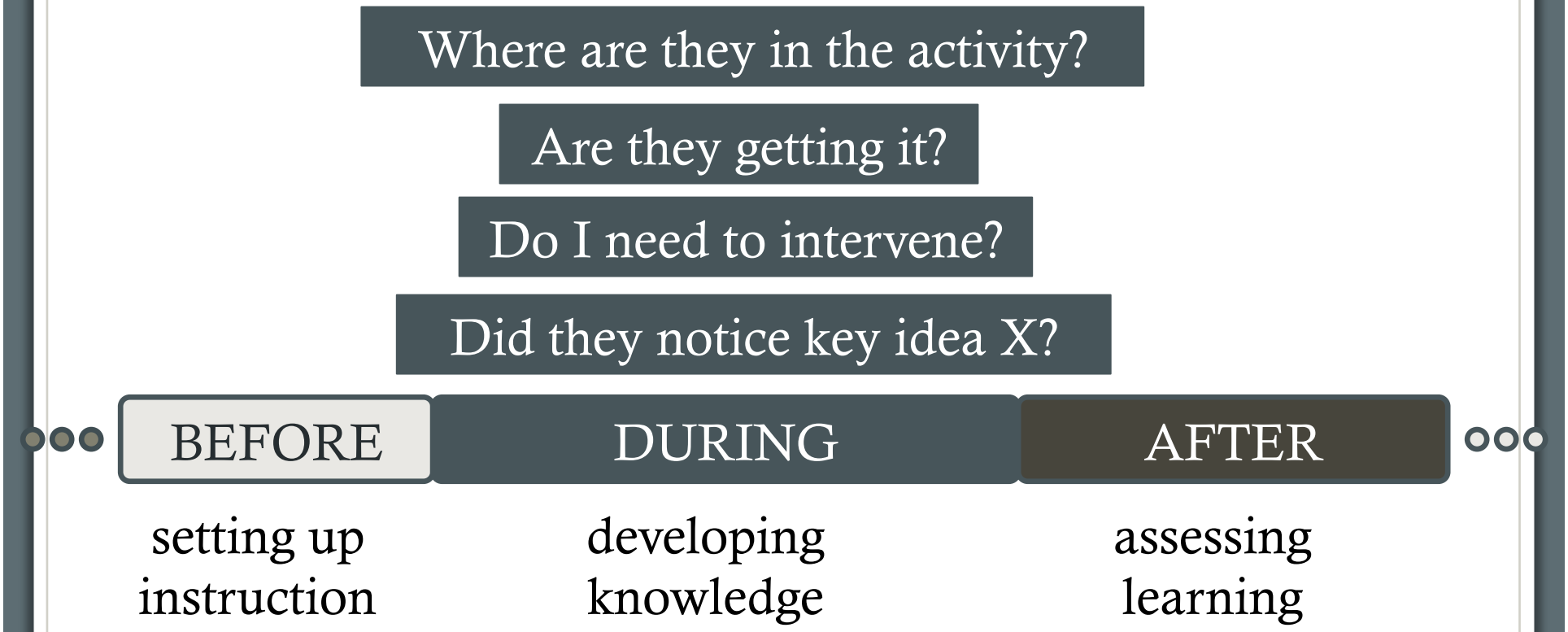
Do they care about this?

What DO they care about, anyway?

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help teachers teach…



Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Questions help teachers teach…

Did they get it?

Can I move to the next topic?

Did that activity work?

How did I do?

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

Clickers vs. other methods of PI

Clickers help in some ways….

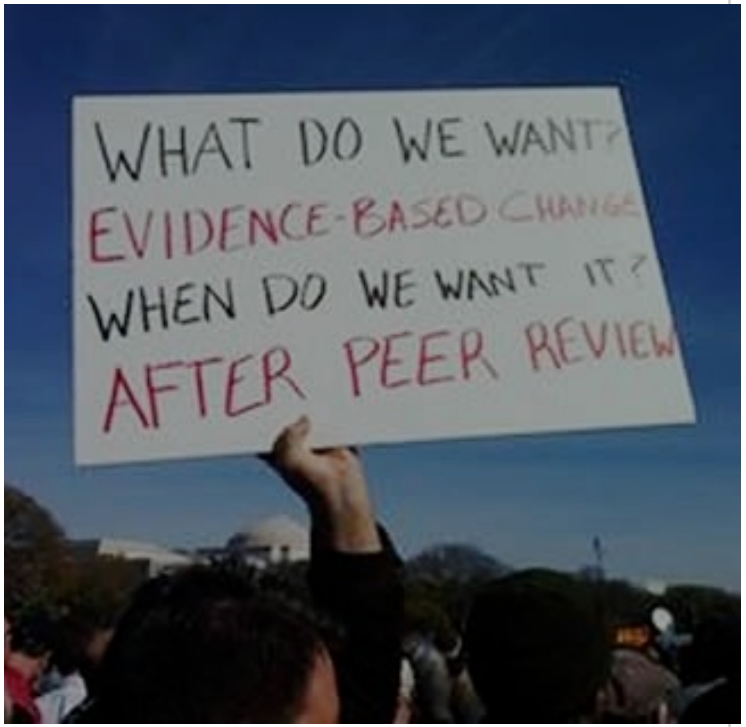
- They are anonymous (to peers)
- Every student has a voice – the loud ones and the shy ones
- There is forced wait time
- You can withhold the answer until everyone has had time to think (choose when to show the histogram)
- You have a record of every student's answer
- They tend to foster engagement

What does this tool help us to do?

Clickers help students learn (the research)

Research shows that:

- Students can better answer a similar question after talking to their peers (especially difficult questions!)
- Students like peer instruction (when used well)
- Courses using peer instruction outperform traditional lecture courses on a common test



See http://STEMclickers.colorado.edu for various references

Clickers & Classroom Culture

Students say that clickers:

- Help them show up for class and participate
- Make them feel part of the class community
- Make their "voice" heard in class
- Hold them accountable for learning
- Increase group learning outside the classroom
- **But only if clickers are used well!**

Let's try it!

A small acorn over time can grow into a huge oak tree. The tree can weigh many tons. Where does most of the mass come from as the tree grows?

A)Minerals in the soil

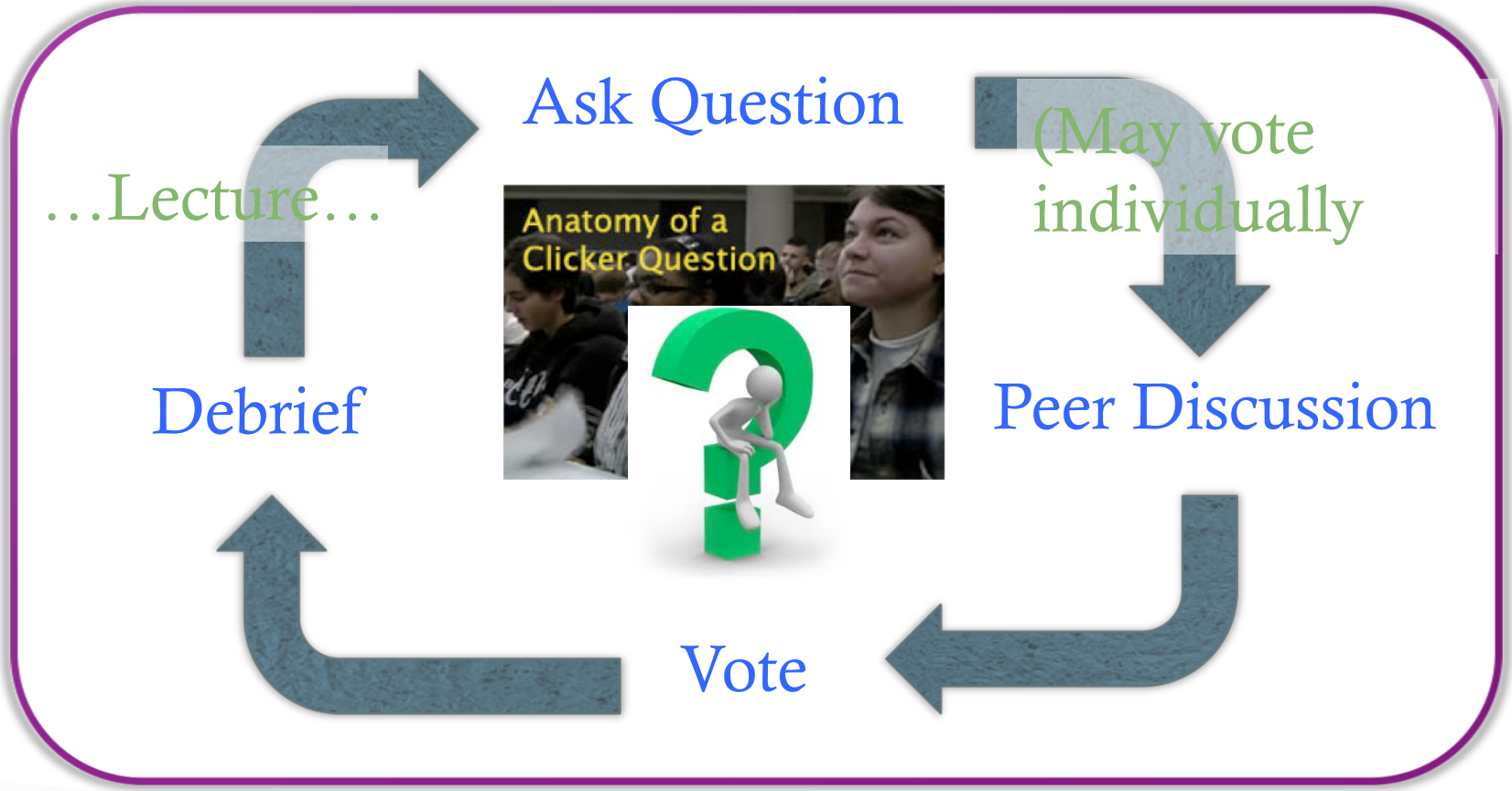
B)Organic matter in the soil

C)Gases in the air

D)Sunlight

A Private Universe; Annenberg Media

Question break



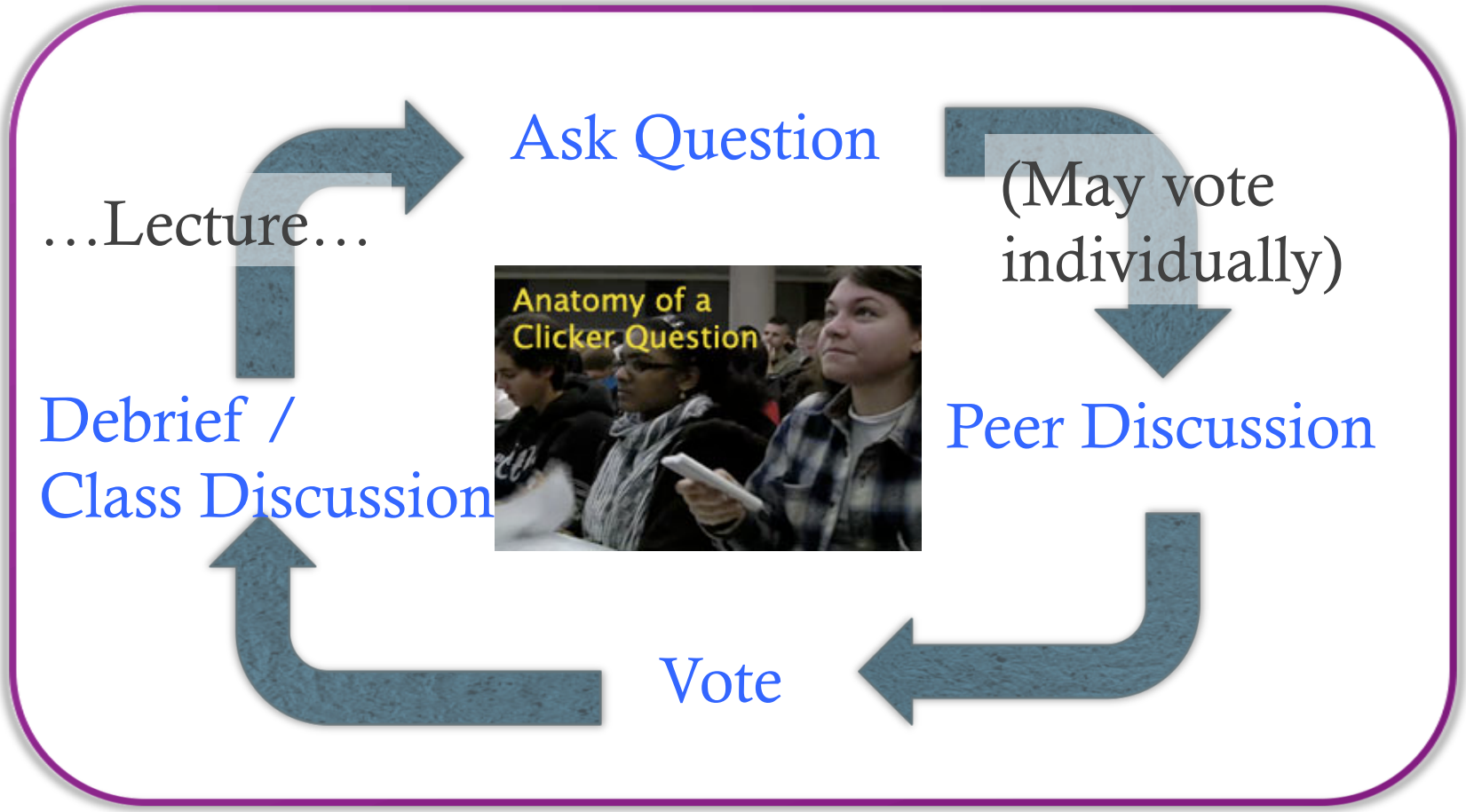
Facilitation Matters

Remember, not a magic bullet!

Or, “the perfect question doesn’t solve all problems”

Implementation is also important.

Anatomy of Peer Instruction



*** See also: Peer Instruction, A User's Manual. E. Mazur.**

Clicker choreography

More in handouts

1. Present the question. Don't read it aloud.
2. "Please answer this on your own."
3. Give the students sufficient time to make a choice.

   "Do you need more time?"
4. "Please vote."
5. Check distribution of votes privately.
6. Depending on the distribution of votes, proceed.

Clicker choreography

More in handouts

6. Depending on the distribution of votes…

   Have students discuss with peers (usually)

   Have a class discussion

   Discuss question yourself

More on this later…

7. At the end, confirm the answer(s) and continue with the class.

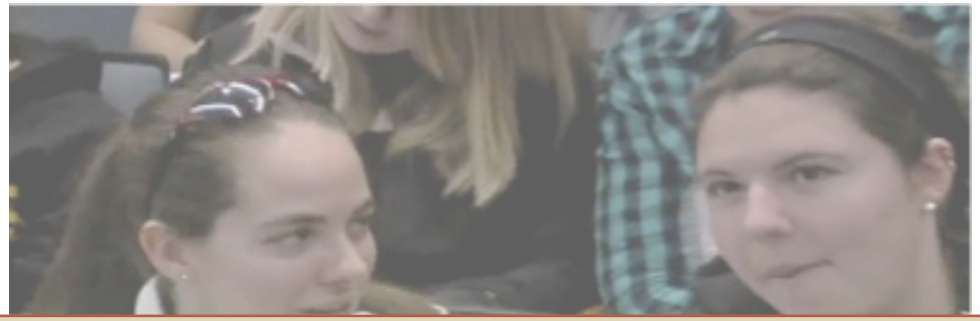
Activity: Challenges

What do you think is / will be the toughest thing about using Peer Instruction?

Brainstorm with neighbors. **Designate a scribe to take notes of your discussion.**

What are some possible solutions to these challenges?

Challenges: Peer Discussion



Best Practices:

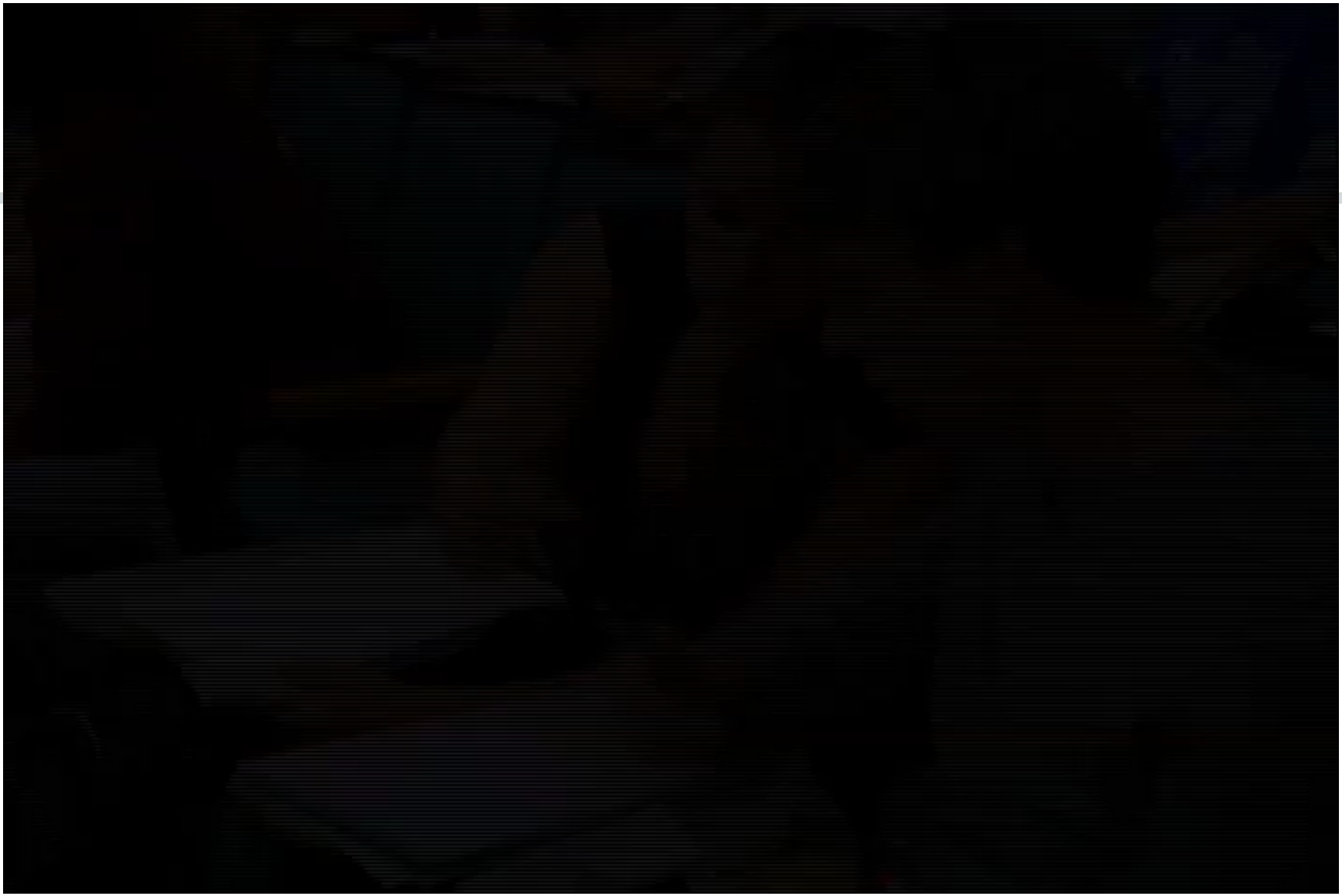
- Circulate and model
- Use questions leading to discussion
- Allow enough time (2-5 mins)
- Focus on reasoning in wrap-up
- Get students to buy-in

JiTT question

- Do you require that every student in the class vote before closing the clicker question?

Student buy-in is key!

And classroom culture!



JiTT question

"Should clicker questions become exam questions?"

"How does a student that has never been exposed to such an environment react at first, and are they in general willing to participate in discussions without any grade reward?"

Student buy-in is key!

At least, explain why you are doing this

Even better, demonstrate why you are doing this by jumping into a question, having lots of meta-conversations, etc.

In your handouts is a link to some example "framing" activities:
http://www.colorado.edu/sei/fac-resources/framing.html

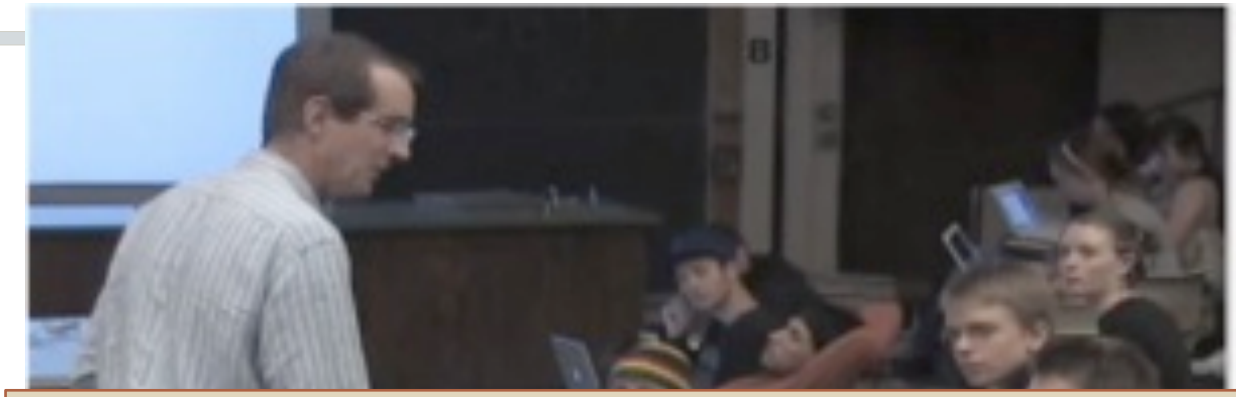
What about grading?

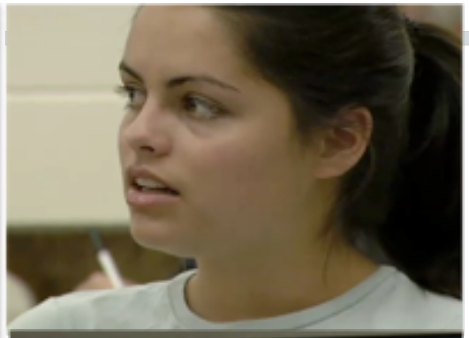
- JiTT question: "From student feedback, I know they don't like being graded on clicker questions. And there was also a comment in one of the videos that if you use them to track students or "test" them, they will not be so effective. But I think there are students who won't bother to think about the questions when it doesn't mean anything for their grade. What do professors typically do to encourage active participation, without penalizing too heavily if a student gets a question wrong?"
- "In the past, I've used 80% as my reference score; if they score 80% or higher, they earn 100% for that part of the grade."
- If the question will count towards a grade, I don't want to put in too many that are difficult…. This give the student a good grade if they've been to class and paid attention, but it doesn't promote discussion very well."

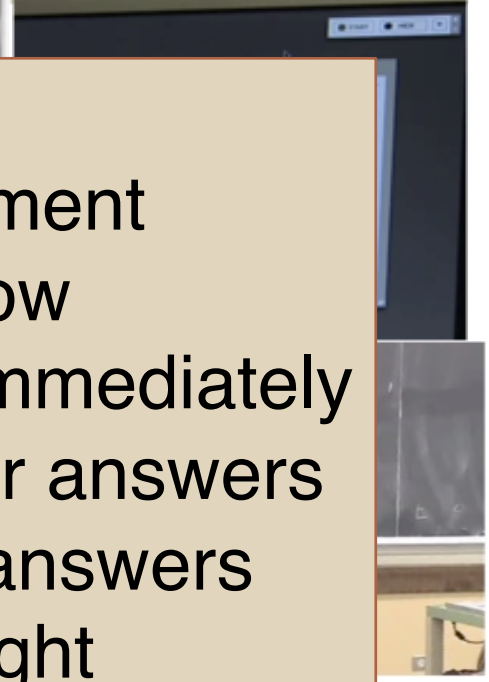
The "Whiff of Credit"

- May provide low-stakes incentive to have a good clicker score.
- Give points for trying, and maybe a little more for getting a correct answer.
- At the end of the semester, substitute the average clicker score for the worst homework score *if it is better.*
- Have clear policies on cheating.

Challenges: Wrap-Up Discussion







Best Practices:

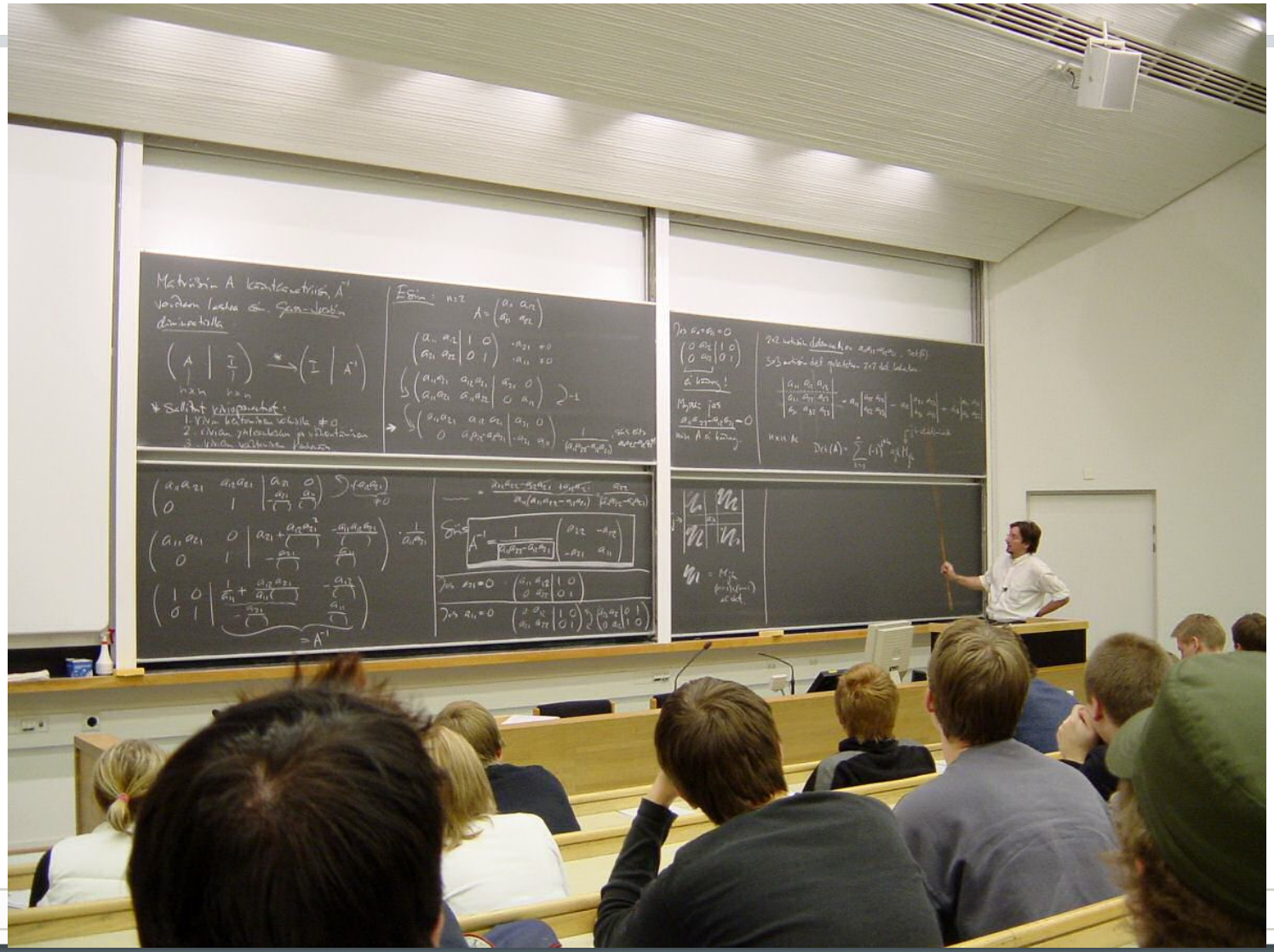
- Establish a safe, respectful environment
- Encourage sharing of ideas somehow
- Don't necessarily show histogram immediately
- Ask multiple students to defend their answers
- Emphasize reasoning: Why wrong answers are wrong and why right answer is right

JiTT question

- How much time would you spend discussing incorrect answers that have low frequency (1-2% of class)?

Giving the answer stops student thinking!

What about content coverage?



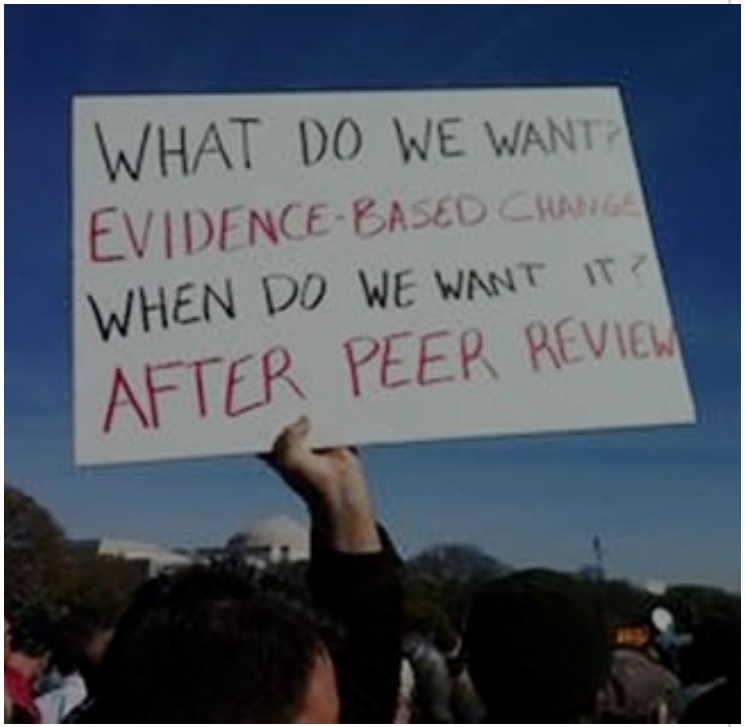
Other things we haven't talked about?

- Other challenges and solutions?

Facilitation Matters (the research)

Research shows that:

- Students prefer time for individual thinking AND peer discussion.
- Peer discussion AND instructor explanation of question works better than either one alone.
- Instructor explanation is particularly UN-helpful for strong students.
- Students prefer 2-5 challenging questions interspersed with lecture.
- High-stakes points have a negative effect on conversation quality.



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Reacting to their Votes

After the (first or second) vote…

Don't show the histogram to the class (yet):

- Popular choices may sway second vote
- A student who picked an unpopular choice may be reluctant to participate in discussions

You can motivate students **without** showing the histogram, e.g., by saying "there seem to be two popular answers"

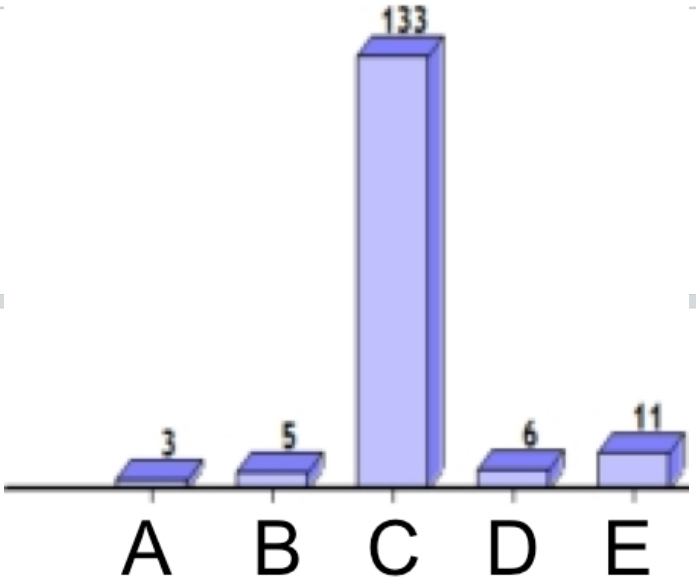
Reacting to their votes

You don't know what's going to happen but you can **anticipate** and **prepare yourself** for the likely outcomes.

When you know the first-vote distribution (but they don't) you have lots of options.

This is where you show your "agility."

First Vote #1

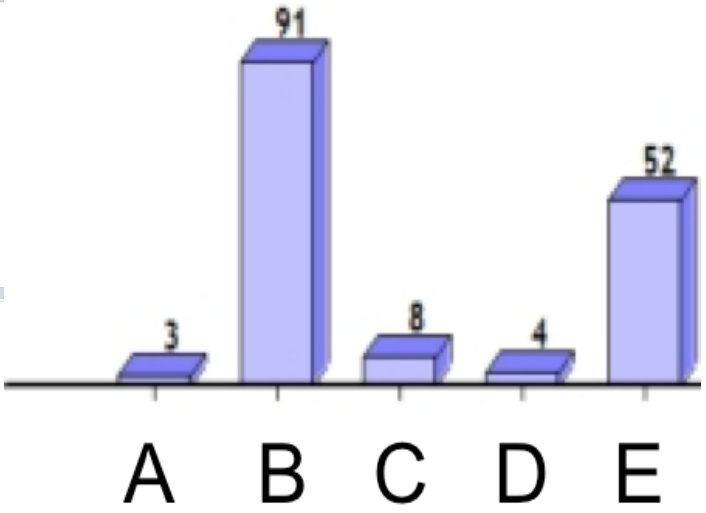


What do you think you should do with this **first-vote** distribution?
(C is the correct answer)

A) "Turn to your neighbors and convince them you're right"
B) Confirm correct answer and move on
C) "Can someone who answered C tell us why they made that choice?"
D) Other

Discuss correct and incorrect choices

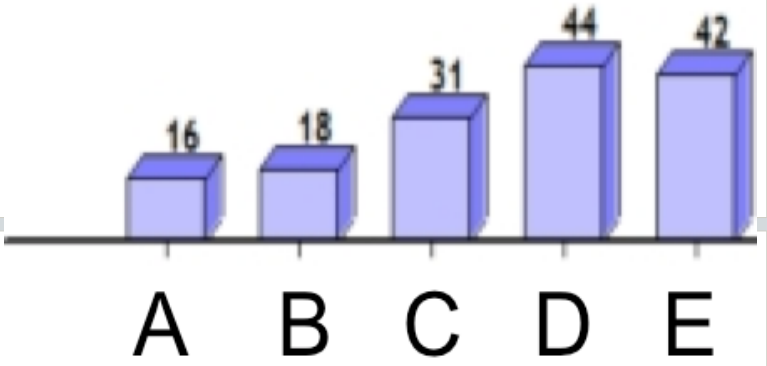
First vote #2



What do you think you should do with this **first-vote** distribution?

A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?"
D) other

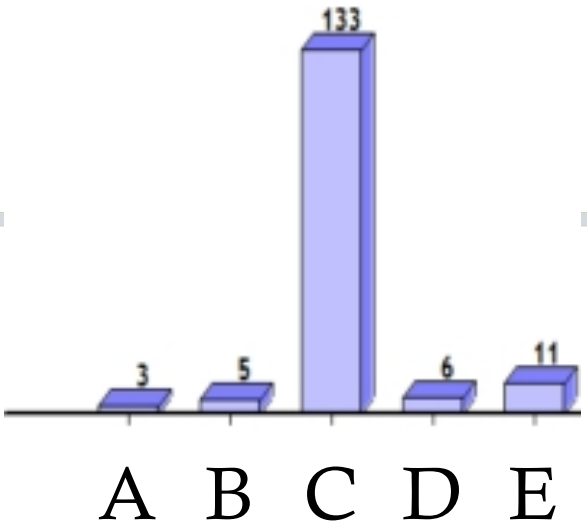
First Vote #3



What do you think you should do with this **first-vote** distribution?

A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?" (etc.)
D) other

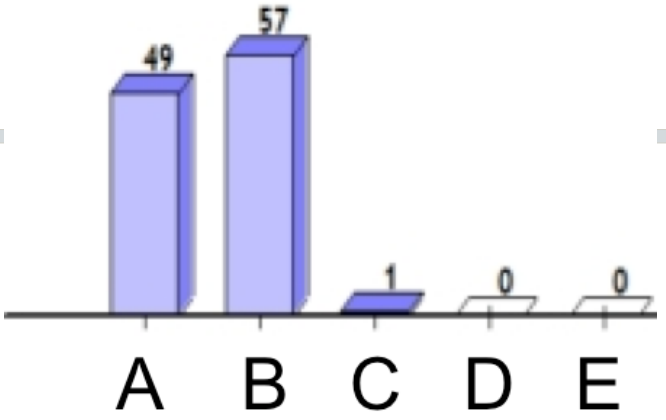
First Vote #4



What do you think you should do with this **first-vote** distribution?
(C is **not** the correct answer)

A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered C tell us why they made that choice?" (etc.)
D) other

Second Vote



What do you think you should do if this is the **second-vote** distribution?

A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?" (etc.)
D) "Would someone like to explain why they picked the answer they did?"
E) other

Action Plan

- Take a few minutes to write down your action plan to implement ideas you heard about in this part of the workshop.
- Email it to yourself!